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# Toward a Sociomaterial Understanding of Writing Experiences Incorporating Digital Technology in an Early Childhood Classroom

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## **Abstract**

This article examines the resources, tools, and opportunities children enact as they engage with teacher-devised writing experiences within their classroom space. We begin with discussion about classroom writing time from the perspective of both the teacher and children of one Grade 1/2 composite class. We also reveal resources within the classroom space to consider the expertise available during writing times. We then examine a 5-week unit that focused on multimodal text construction. Using optical flow computer vision analysis to examine the movement of children during four video-recorded independent writing instances, we provide commentary about how the classroom writing experiences have been interpreted as the use of space, resources, and interactions come to the forefront. In taking this approach, this article will explore learning to write from a sociomaterial perspective, as we investigate the operation of the classroom.

## **Keywords**

sociomaterial, toward, writing, experiences, incorporating, digital, technology, early, understanding, childhood, classroom

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## **Abstract**

This article examines the resources, tools, and opportunities children enact as they engage with teacher-devised writing experiences within their classroom space. We begin with discussion about classroom writing time from the perspective of both the teacher and children of one Grade 1/2 composite class. We also reveal resources within the classroom space to consider the expertise available during writing times. We then examine a 5-week unit that focused on multimodal text construction. Using optical flow computer vision analysis to examine the movement of children during four video-recorded independent writing instances, we provide commentary about how the classroom writing experiences have been interpreted as the use of space, resources, and interactions come to the forefront. In taking this approach, this article will explore learning to write from a sociomaterial perspective, as we investigate the operation of the classroom.

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**Keywords**

writing, early childhood, sociomaterial, digital technologies

To understand the diversity of writing pedagogies and practices utilized within early childhood classrooms, we need to examine instances of classroom practice to showcase the interrelationships between the material and immaterial influences on young children's writing development. Leander and Rowe (2006) challenged us to consider and interpret the "public performances" (p. 428) played out in classrooms as we examine the ways texts are used, how bodies are moved and the interactions that take place in classrooms. This article aims to investigate the material and relational dimensions of learning to write (or produce texts) in the early years of school.

Understanding pedagogies requires attention to movements and interactions in classroom spaces, the selection and uses of resources, and the products produced by young children. Leander (2004) argues that space organizes individuals. The ways then that individuals interact, or appropriate resources, within spaces enable them to offer transformations through what they produce. Classrooms as spaces where learning events unfold ultimately shape the experience of the learning.

While writing pedagogies have typically employed a range of resources to facilitate children learning about text production, the relatively recent infusion of digital technologies into literacies pedagogies has the potential to change the ways children engage with text and ultimately what texts they are able to produce and comprehend. Taking Rosenblatt's (1994/1978) notion of transaction, it becomes critical that we consider the importance of the "dialogue" that exists in classrooms where students and teacher interact with the resources available to them. In doing so, we use a transactional literacy theory to refer to the active engagement of children with any material—including texts, tools, and resources within the classroom. Burnett, Merchant, Pahl, and Rowsell (2014) define material as "stuff"—such as artefacts, walls, texts, and screens (p. 92)—available to learners in their classrooms. While this is typically taken for granted in print-based writing, the inclusion of digital technologies broadens the volume and diversity of available materials. With these shifts, it is important to consider pedagogical ways teachers guide children's use of materials as they learn to write, and the ways children actually use and engage with them.

We understand literacy to be a social practice. Writing is highly contextual, and is interwoven into contextual purposes, is various in form, and responsive to the ideological complexities of time and place (Brandt, 2015; Heath, 1983). Children engage with materials as resources within their environment, and as they become more proficient with literate practices, they talk, handle materials, and participate in activities in ways that are expected of them by teachers and school (Rogers, 2011). Teachers make pedagogical decisions, as they implement routines and interactions with the intention of facilitating student learning. Leander (2004) describes this as "... a set of discursive and material practices and resources that actively engages in the production of power relations and ideology" (p. 127). In classrooms, children negotiate tensions

between and among individuals, materials, and social relationships as they work within the classroom context (Wohlwend, 2007).

With this in mind, this article aims to achieve two purposes through a detailed analysis of perspectives captured from both the teacher and children and by investigating how these are enacted within classroom writing experiences within a teacher-planned 5-week unit of work. Firstly, we examine the perspectives gathered from the teacher and the children about aspects of classroom space, resources, and interactions that are important during classroom writing experiences. Secondly, we examine how these perspectives are enacted through opportunities for text production during a planned unit of work using an optical flow (OP) computer vision algorithm to provide in-depth analysis of four instances of actual classroom activity to identify who interacted with who and what.

## Theoretical Framework

We employ a sociomaterial approach to understand how concepts of writing knowledge are represented in everyday classroom action. This approach acknowledges that literacy is culturally specific (Heath, 1983) because it is not only “situated within material culture . . . it is in itself a material, cultural practice” (Rowse & Pahl, 2011, p. 178). We focus on the intricacies of classroom writing as we examine how materials, ideas, practices, and pedagogies are brought together in ways that are always active and interrelated. Our objective is to “understand how things come together, and manage to hold together” (Fenwick & Edwards, 2011, p. 2) to produce knowledge about writing pedagogy through careful examination of the “situatedness” (Fenwick, 2014) of learning processes and their many interrelations. To do this, we investigate the everyday teaching and learning practices, the materials, tools, and texts used and spatial arrangements that constitute writing pedagogy in one classroom.

The classroom is an example of a “material culture” through which the types of experiences it comprises, resources it offers, and the physical space itself can be considered. This view of material culture acknowledges the interrelationships between the time, scale, space, resources, people, and interactions. A sociomaterial approach allows for careful examination of interplay between the physical, temporal, and spatial elements that contribute to a young child’s writing practice. It appreciates that learning to write is affected by a range of assemblages (Fenwick, 2014). This approach offers a “method by which to recognise and trace the multifarious struggles, negotiations and accommodations whose effects constitute the things in education” (Fenwick & Landri, 2012, p. 2).

## Method

### Context

This article draws on data collected as part of a federally funded Australian multisite ethnography where teachers, researchers, and children have worked together to

provide a fresh understanding of how the teaching of writing is enacted across schools at this time. Here we focus on one school and one composite class of 6- to 8-year-old children and their teacher.

### ***Broader Study***

The exploratory qualitative design of the larger study addressed the following questions:

1. How, when, where, with what, and with whom are children writing in early childhood classrooms?
2. What are the implications for teaching and learning, when writing and other text production is understood to involve: collaborative practice; and tools, resources, and devices that are print and digital?

Prior to classroom observation detailed in this article, the researchers conducted an audit of current practices of teaching and learning writing. Children were interviewed individually to gather their perspectives on writing and were asked about when they write, where they write, who they write with, and the resources they use when writing. These data revealed key resources identified by the children and also detail about who the children perceived held knowledge about writing that would be helpful to them as they learned to write. In this phase, each teacher involved also completed a survey where they were asked to report details about their approach to the teaching of writing in their classrooms. Teachers provided information about times and places where writing and text production typically occurred, the range of materials that children had access to in order to produce texts, the types of writing assignments (in terms of topics, genre, length, and expectations), opportunities for students to write collaboratively, opportunities to employ new technologies, and any other comments they chose to make. Through this audit, details of the writing practices that children engaged in as they learned to write were collected.

After the results of these initial audit tools were reported to the teachers as a whole group, each teacher identified suitable times for initial observation of writing experiences in their classrooms. The children engaged in classroom writing experiences that were planned and implemented by the participating teacher. These experiences were video recorded, supported by field notes and student text samples. During this time, teachers also participated in focus groups and collaborative planning sessions, facilitated by the researchers and focused on the teaching of writing. Over two 10-week terms, the first named researcher visited the classroom weekly to observe the teaching of writing. In the third term, the teacher designed a 5-week unit of work that is the focus of discussion in this article.

### ***Site and Participants***

The school is situated in an urban suburb of a large seaside city of New South Wales, Australia. This suburb was formerly a hub for heavy industry that provided

employment for the local population. The school, which enthusiastically joined our study, is a coeducational government funded school with a student population of approximately 180. This figure represents a 19% drop in enrollment since 2008. Currently, 12 teachers and 4 nonteaching staff work with children across kindergarten to Year 6 (Australian Curriculum, Assessment and Reporting Authority, 2016). The three early childhood classrooms—kindergarten and two composite classes of children in Grade 1 and Grade 2—which included children aged 4–8 years participated in the research.

Participants represented in this article include 1 teacher and 25 students in a Grade 1/2 composite class. The teacher was in his third year of teaching and the children were aged between 6 and 8 years and in their second or third years of school. Together, the teacher and students embraced learning opportunities in their classroom.

### *Data Analysis*

An innovative strategy for video collection was used to capture classroom activity within this 5-week unit of work. In order to capture longitudinal video data and to remove the obtrusiveness of a research team, an observation system comprising portable cameras, a networked base station, and a digital audio-recording system was installed in the classroom. The classroom teacher controlled the video recording, as he made decisions about when to turn it on and off in order to capture classroom writing experiences. A significant corpus of video data was captured (approximately 17 hr) during this 5-week period.

As a first pass through the data, the recordings were analyzed for face-to-face interactions, movements, and behaviors, as meaningful information was extracted from the videos using an OP computer vision algorithm (Howard et al., 2017). OP is an approximation procedure, which targets the motion field—in this case, the classroom—by mapping visible points from one frame to another in a video sequence. For the purposes of this article, instances when children were writing independently at different time points in the 5-week unit were extracted from the larger corpus and then mapped according to where the children moved. This was a way to identify who interacted with whom and what resources they used during these times.

A sociomaterial approach as a “meta-theory” allows for an extension of the scope, depth, and effectiveness of data analysis. As suggested by the term, sociomaterial approaches conceptualize the social and the material dimensions of a space—for example, a classroom—as being inextricably linked. According to this way of thinking, the human and nonhuman and their relationships are equally worthy of study. Considering the material along with the social, cultural, and individual in any given space enables a focus on relationships and for the writing classroom to become an object of study. Hence, the writing classroom becomes an object of study in its own right. As such, we focus on:

- when and where writing time occurred;
- tools, materials, technologies, and relationships employed as students created text; and
- texts produced: modes, purposes, and audiences in writing time in primary classrooms.

## Findings

### *When and Where Writing Time Occurs in This Classroom*

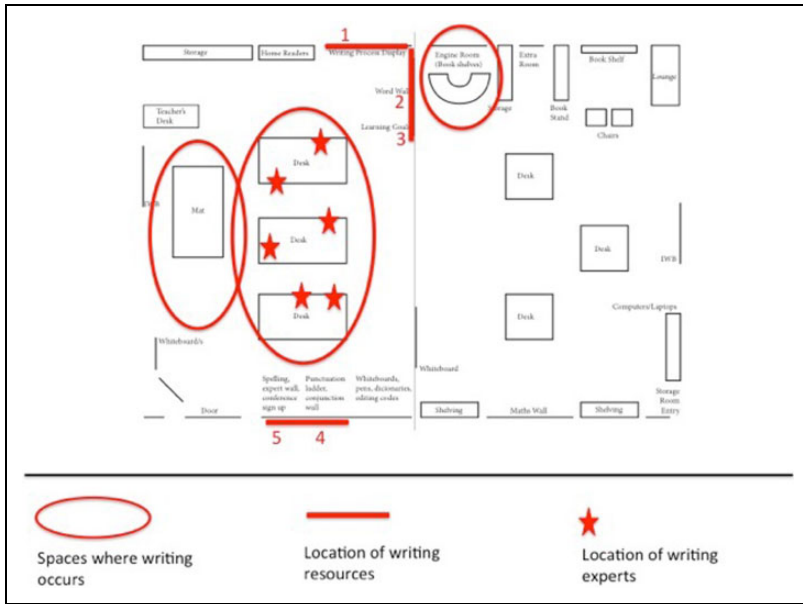
*The teacher's perspective.* Each teacher in this school had a double classroom space to work within. The large space provided the focal teacher with significant display surfaces, and the ability to designate particular areas to specific activities. He identified specific areas and resources for writing and experts within the classroom space. These are represented in Figure 1 and are discussed below.

The teacher reported that writing is taught in this classroom 4 times per week. He described hour-long writing sessions that occurred on these days. He detailed that he leads the children through modeled writing on the floor space early in these sessions, where the focus is on text structure, language choices, and spelling. Modeling episodes are typically scheduled for 30–40 min. Following this modeling, the children engage in independent writing time at their desks where they continue to write, extending the teacher's modeled text for anywhere between 10 and 20 min. Additionally, four afternoons each week, the children participate in "freewriting" for approximately 30 min. The teacher identified this time as being in addition to episodes where he was "teaching" writing. He explained that during the latter time, the children write in workbooks with a pencil as they select their topic and genre. There is no expectation for them to share the text they produce; rather, his focus is on process with the intention to build writing stamina and confidence.

The "engine table" featured heavily in the teacher's talk about planning and teaching for writing experiences. This semicircular table, slightly removed from the other table groups, provided an intimate space for explicit teaching of writing skills and strategies. During classroom observations, the teacher was seen to identify children for small group instruction to occur at this table. When asked to identify resources within the classroom that supported the children as writers, the teacher identified five key areas (numbered in Figure 1). These were:

1. The "writing wall" contained *spelling words* for the week, the *developmental groups* the children were organized into, and a visual representation of the *writing process*.
2. The "word wall" contained a laminated sheet for each letter of the alphabet. Words were written onto this using a whiteboard marker. Each sheet could be removed by the children for use and then returned.
3. Individual "learning goals" were written and hung onto the wall. It was the teacher's intention that each child would remove their learning goal prior to writing and have this on their desk as a reminder of their focus.

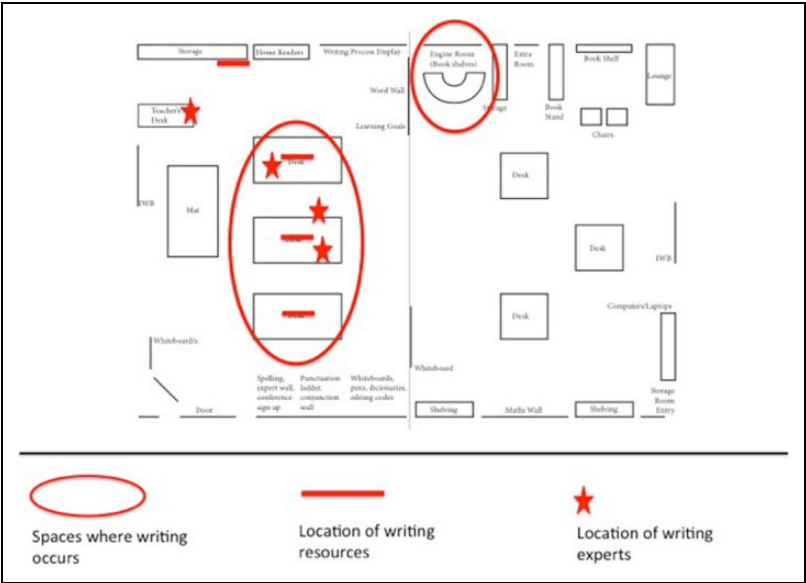




**Figure 1.** The teacher's perspective of writing within the classroom space.

4. The “punctuation area” displayed punctuation marks for the children. Alongside it was a *ladder* that provided a hierarchy of the punctuation marks and children’s names were arranged alongside this to show competence with the punctuation form.
5. The “writing center” ran across the wall near the entrance to the classroom. It provided *writing samples* that were rated (one to five stars, with five stars being the best). Some samples were from children and others were from curriculum support documents. The teacher identified specific *workshops* for guided instruction and allocated names of children to these. There was a *sign-up* sheet for children if they wanted to talk with the teacher. *Experts* in the areas of planning, spelling, paragraphs, editing, feedback, and conferencing were identified with a photograph and named as available to support their peers. The location of these experts is indicated in Figure 2 with star icons.

Arrows on the floor marked the teacher’s anticipated movement of children through these resources. Of note here is the actual assignment of places and labeled roles to specific children. As we will demonstrate below, the children understood these material designations as evidence of how they were assessed within the social and academic spaces of the classroom. In addition, as observers, we were struck by the investment of teacher time in producing the paraphernalia associated with his writing program, a point to which we return in the Conclusion section.



**Figure 2.** The children's perspective of writing within the classroom space.

*The children's perspective.* Consent to be interviewed was obtained for 23 of the 25 children. Data collected provided evidence that children were aware of regular writing routines. Specific spaces, resources, and experts identified by the children during interviews are represented in Figure 2 and explained in the subsequent discussion.

The children unanimously described writing as something that happened at classroom tables. The majority described where their table was and who sat around them. Three children made explicit reference to the engine table as a space where they often wrote. For example, Max (all names are pseudonyms) talked about his teacher's decision for him to write at this table stating it was "so he can see me." When asked why this was important, Max responded, "because I do more work." Each child was asked individually who they write with in their classroom. Half identified their teacher. Twenty classmates were also explicitly identified and named. Five children were not mentioned at all. Three children were identified by more than five peers—Ben (seven references), Cait (six references), and Conor (five references). A star icon in Figure 2 indicates where these children were seated. Interestingly, Conor is the only "expert" identified by the teacher who is also identified by children. Conor is also discussed below.

Children reported writing with peers as a positive experience, as they sought advice about spelling (12 references), to get ideas or compose the text (10 references), to edit (8 references), or to check their writing was "neat" (4 references). Tara described,

**Table 1.** Overview of Video Instances for Optical Flow Examination.

Video Index	Duration	Synopsis of Video
1-102016	12 min	Children are planning their short-story text
2-102616	11 min	Children use their short story to create a storyboard
3-103116	7 min	Children use storyboard to create image and sound files
4-111416	9 min	Children refine and conference their soundscape text

Umm, well whenever I get stuck on a word, I say, “Evan do you know how to write this word?” and he says “yes” and then he’ll spell it out. Then I will write it down and he’ll reread it over again and, and say “yes” or “no” if I got it right or wrong.

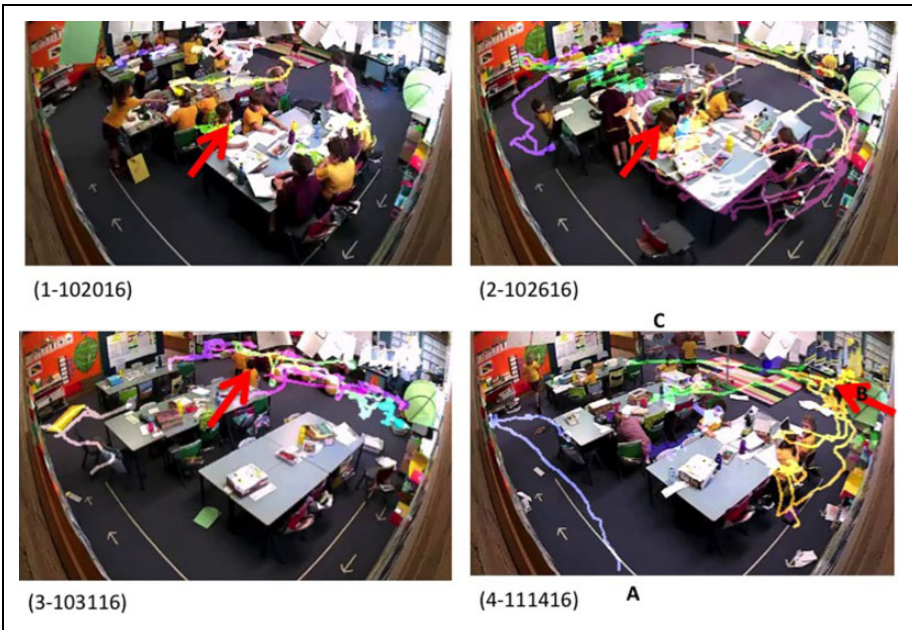
In one instance, Jack identified that working with someone else was not always helpful as he described, “but sometimes when I start talking to Zac, I start talking about things that aren’t my writing.”

Children identified resources they used during classroom writing time. All said they used a pencil. Children all spoke about writing “in a book.” They revealed two writing books—one for “writing” and one for freewriting. Colored pencils were identified by half of the children as they described their use for planning (seven references), editing (five references), and drawing pictures (three references). Three explained that they used crayons and markers, and one spoke about a pencil grip.

Other general classroom resources were also identified. For example, three children spoke about their spelling book as somewhere they could look if they needed help to spell a word. Four children spoke about the word wall, with one explaining “he [teacher] puts words on the word wall to help us.” One child who described how once he got to publish his writing on the computer made the only reference to technology as a resource. He also stated, “today the computer doesn’t work.”

*Examining These Perspectives in Action During Writing Experiences*

The writing experiences selected for investigation here draw from a cumulative sequence of tasks over a 5-week unit conducted primarily during the morning writing time. Over this period, the teacher implemented a unit of work designed to draw children’s attention to different modes that come together to create a story (see Table S1 in the Online Appendix for overview). He acknowledged that written text was privileged in his classroom, but he also wanted children to understand the power of audio and visual texts. He saw this as an opportunity to build upon print-based literacies but to also extend these into digital literacies. As such, he planned for each child to independently create a “soundscape text” that would tell a story using images and sound created with digital technologies.



**Figure 3.** Movement trajectories from optical flow analysis.

*Processes enacted during the experience.* Four instances of independent writing were selected for examination using the OP computer vision algorithm. Table 1 provides an overview of these instances. Prior to these time periods, the teacher had provided modeled writing lessons. Analysis of the OP gave insight about the children's movements, with whom children interacted, and the resources they used as they produced text.

Figure 3 illustrates trajectories in operation in the classroom at these times. In each classroom map, most frequent trajectories are numbered. In each image, an arrow identifies Conor (as a recognized expert by the teacher and children).

During the initial planning stages (1-102016), children collaboratively developed writing ideas as a group with the teacher in front of the interactive whiteboard (IWB) before returning to tables to write. We see limited interaction between children; reaching for pencils on their tables appeared the greatest movement at this time. Conor interacts with a peer sitting immediately behind him.

More activity was captured, as the children worked with their narrative to create their storyboard (2-102616). The children moved around the classroom (although not in the direction or the space marked by the arrows on the floor). There is movement across to the writing wall, although no trajectories indicate they have stopped to use any of these resources. The writing center has been frequented as children review guided groups and sign up for extra help. The area containing the names of "experts"

has not been visited by any children. The tops of the tables are covered with resources including the teacher-developed storyboard planning worksheet, writing books, and pencil trays. There appears interaction between and among the children throughout the duration of this instance. Conor interacts with peers sitting behind and beside him. He also moved to the front of the classroom to talk with the teacher.

As the children refine their storyboards (3-103116), they do this in front of the IWB with the teacher. The children have their storyboard worksheets with them, and they use these to capture the detail their teacher is requesting. There is a computer on the teacher's desk; this is used consistently by a group of children, as they search for the sounds they are planning for their soundscape text. Conor was positioned at the back of the floor space during this time where interactions between him and peers sitting in the back row of the floor space were captured. Conor did move to the teacher's desk to use the computer to search for images before moving to a table to work on his text.

As the children refine, conference, and record their soundscape text (4-111416), we see the most movement in the classroom. The computer on the teacher's desk is used again, as are laptop computers on the tables. In this example, we can follow trajectories of different children's movements during this writing instance. Trajectory A had the longest path, but without interaction with peers. It appears this student has left their table to speak with the teacher and then relocated to a different table to continue their text production. Trajectory B shows Conor and a peer who worked alongside each other at the table and moved together to talk to the teacher, to look at what the children working on the computer on the teacher's desk were doing, before moving back to their tables to work on a laptop there. Trajectory C shows the relocation of a child to the back of the room to complete their recording.

## Discussion

By using three components of data from the large corpus available, this analysis allows for a variety of elements and perspectives to be foregrounded.

The teacher demonstrated clear intentions for his writing pedagogy. He created resources that he intended the children to use during periods of text production. Removable resources on the "word wall" invited the children to access support without the requirement to approach an adult or even other children. Resources such as "learning goals" were designed to provide explicit instruction for individual children with the aim of supporting their success. The plotting of children according to developmental abilities provided an immediate reminder to the children of where they were positioned according to teacher assessment of their writing. While the teacher has a broader focus on writing, the constrained skills of writing appeared to be those favored by the teacher in classroom displays and resources. In the initial audit of the classroom, the teacher made no reference to the role of digital technologies for children's text production.

The children understood writing to be a regular routine in their classroom that was completed in predictable places (i.e., their tables) in their classroom space. With the exception of immediate physical resources (such as pencils and books), the social resources their peers offered appeared most favored. Children made little reference to the teacher-made resources (the word wall being the only teacher-identified resource acknowledged by any child). Only one child identified the use of the computer for publishing purposes during writing experiences.

Examination of the four instances of independent writing provided insight into how the children moved within the space and utilized specific resources. The teacher designed the writing tasks the children were to complete and in 1-103016 and 3-103116, we see quite firm control over the physical space the children occupied. These instances show strong teacher control and resource use restricted to the physical location of the group, as the children worked at their tables or on the floor in front of the IWB (both central writing spaces identified by the teacher). While 2-102616 and 4-111416 showed greater flexibility of movement, this movement tended to relate to the seeking of additional help through interactions between and among peers and the teacher. This indicates different transition points that exist within text production experiences.

The introduction of digital resources in 3-103116 and 4-111416 appears to encourage movement within the space and social interactions, and this raises interesting questions about why there was so little discussion of computer or digital technologies when the teacher and children reported on teaching and learning writing in the class. What the children did during these independent writing times provides insight into the resources they choose to use and their use at different points during text production. While there is some overlap between this and what the teacher and children reported when discussing learning to write in the class, there are discrepancies as well. As one example, the teacher and children reported that children write in desks—and yet the video data provide evidence that there is a good deal of movement of people in this room, as people access other resources such as computers and are grouped in different ways with different people. Despite the teacher foregrounding the resources he provided to support the children, video footage demonstrated that there was little connection to or use of these writing resources. However, children demonstrated their ability to use social resources to support their text production practices.

Both teacher and children had a sense of the expertise that existed among the class. The teacher formally identified and acknowledged experts through the “expert wall” and the equal distribution of this expertise across table groupings. Children were also able to identify peers from whom they sought advice during writing. It is interesting to note that Conor was the only child whose expertise was acknowledged by both teacher and peers. As a recognized expert, there were frequent demands on him during writing, yet there were privileges too. Further investigation of child expertise and the relationship with individual and collective learning in writing time would be fruitful.

The teacher’s focus on modality in this unit of work demonstrates an important progression in his understanding of what constitutes writing. The initial audit of his

classroom showed clear privileging of written text, with particular emphasis on constrained skills. The teacher acknowledged this in his planning of this unit and purposely planned a final task for children to create a soundscape using audio and visual texts. However, the written text remained privileged; it was completed first and then deconstructed to enable the creation of audio and visual texts. It is possible that increased accountability evident in the current education testing agenda drives the focus on written texts, as they can be more easily assessed and accounted for. Perhaps too, written texts are still considered in broader, sociopolitical contexts as essential to being literate.

The instances of writing that the teacher decided to record provide further insight into the text production that he perceived as valuable. Just over one third of the video captured (350 min) showed explicit teaching of writing, as text was either deconstructed or constructed by the teacher, with minimal connection to the writing resources in the classroom. While the majority of the footage (675 min) showed the children engaged in independent writing, in more than two thirds of this time (465 min) the children produced a teacher-directed text. Technologies for children to use to produce text were introduced in the later week and a half of the 5-week unit of work. The OP computer vision algorithm identified where children go and what they do during these instances. While we get a sense of the overall movement across the classroom, we need to know more about how this connects with the teacher's intention and the individual texts produced by these authors. It is evident however that Conor's relative mobility, frequent interactions, and use of the laptop away from the teacher's desk stand in contrast with Max's placement under the teacher's gaze at the engine table.

## Conclusion

Our examination of classroom writing time for these young children enables us to capture the close and networked relationship between tools, technologies, resources, and people as they write. Interaction across materials, space, and pedagogical practices enables transformative learning (Rosenblatt, 1994/1978), which ultimately shapes the texts children create. There is need to further examine the use of technology for text production alongside more traditional resources (Rogers, 2011).

Our research argues for a repositioning of print-based and digital resources in writing classrooms. While the teacher's intention in the unit of work was to engage children with written, visual, and audio elements to create text, the written aspects of text production came first, and producing the written text took the majority of the time. The teacher controlled the early use of technology in the unit of work (through the IWB). The class computers and laptops were used only in the final stages (after the written texts had been produced). Writing tasks should be designed to enable the children to negotiate resources and spaces to create diverse and transformative texts (Leander, 2004). Children demonstrated their preference and desire for social interactions through their movements within the space. These social practices, and the

wider learning opportunities afforded through the flexible and recursive ways in which children produce text with technology, are yet to be fully explored.

A sociomaterial approach provides a distinctive perspective on understanding writing pedagogy in early childhood classrooms. It offers insights into writing experiences as negotiated in specific classroom spaces. Combined with teacher and children's perspectives, we can read the classroom alongside the teacher's stated pedagogic intentions and in relation to the children's perceptions and move around the classroom spaces, utilizing resources, and drawing on expertise to produce text. Understanding writing as a sociomaterial process that involves learners collaborating with peers and experts and drawing on tools, resources, and texts to produce their texts shifts the research gaze away from the individual writer alone. Yet, we can also see that writer identities are shaped by the very materiality of classroom spaces from engine tables to lists of peer experts. Importantly, we can also see how hard the teacher works to display the kinds of practices valued by various authorized literacy programs at the regional and school level, making space and time where he can for a more expansive approach to writing and text production.

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Supplementary material is available for this article online.

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